

“Always on the Table”: Revealing Smartphone Usages in everyday Eating Out Situations

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ABSTRACT

Research on food practices and technology use is becoming more common, albeit with a constant technological determinism with respect to the support of individual practices. Nevertheless, there are only a few empirical studies that outline the use of current technologies within eating contexts. We therefore conducted an empirical study on the practice of eating out and the use of mobile technologies before, during, and after eating. Our investigation consists of a qualitative interview study (n=29) complemented by a large observational study (n=458) within several restaurant settings. Our results indicate a strong reluctance to use technology *while* eating and highlights several design spaces focusing on *before* and *after* the actual eating. Within our paper, we uncover a strong relationship between smartphone use and the social settings in which the interaction takes place. We contribute to the emerging research field of Human-Food Interaction by outlining design spaces for supporting practices around food consumption when eating out.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in ubiquitous and mobile computing.**

KEYWORDS

Human-Food Interaction, Empirical Study, Eating Out, Smartphone Usage

ACM Reference Format:

Philip Weber, Philip Engelbutzeder, and Thomas Ludwig. 2020. “Always on the Table”: Revealing Smartphone Usages in everyday Eating Out Situations. In *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society (NordiCHI '20)*, October 25–29, 2020, Tallinn, Estonia. ACM, New York, NY, USA, 13 pages. <https://doi.org/10.1145/3419249.3420150>

1 INTRODUCTION

Food has always played a crucial role in our society. Today, eating out has become a common occurrence that can be considered a

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NordiCHI '20, October 25–29, 2020, Tallinn, Estonia

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ACM ISBN 978-1-4503-7579-5/20/10...\$15.00
<https://doi.org/10.1145/3419249.3420150>

mundane activity [61]. Eating, as well as eating out, go far beyond the mere intake of food, often including many cultural and social aspects [53]. Eating out has a direct impact on one’s lifestyle [58]. Although food and eating practices are ubiquitous, we know relatively little about our daily eating practices and how they are now performed [17]. Today, modern technologies have changed the way that we deal with food. Images of food are shared via social media [15, 63], recipes are accessed digitally on the web rather than from a physical book [9], and restaurant bookings are made directly via smart voice assistants [84]. However, when focusing on these new technologies, it is important to reflect on their social acceptance relative to food-related practices [47], as it is, for example, “no trivial task” to design technologies for family meals that do not negatively affect the social experience [27].

In recent years, the research field of Human-Food Interaction (HFI) has emerged as a subarea of HCI, and it aims to investigate the diversity of ways that people interact with food. These “food practices” range from production, shopping, eating, cooking, and growing to the disposal of food, and they are examined from a diverse set of perspectives [16] such as social identity [29], choice, and ethics [43], and the changing cultural climate (e.g., [14]). Within our empirical study, we contribute to the field of HFI by investigating eating out in relation to the use of mobile technologies. We aim to shed light on current practices around technology-related behavior when eating out and to identify associated design challenges in the field of HFI. Our work explores the following question: “What practices exist around mobile devices within eating out settings?” By addressing this question, we tackle the socio-technical context of eating out and orient to design implications for designing within and for eating out situations.

2 BACKGROUND AND RELATED WORK

Our research lies at the intersection of two bodies of literature. The first emphasizes practices of eating, specifically the practice of eating out, and the second focuses on Human-Food Interaction (HFI), specifically studies on smartphone usage patterns within eating-related contexts.

2.1 The Practices of Eating and Eating Out

Food is always a “political issue, a matter of leisure and recreation, a topic of health, a resource for media industries as well as a primary necessity of daily life” [77]. The eating of food goes far beyond its mere intake, as this act usually encompasses many cultural and social aspects as well [24]. Warde and Martens [79] showed that

eating out had a “special” meaning to most people at the time, describing it as follows: “a specific socio-spatial activity, it involves commercial provision, the work involved is done by somebody else, it is a social occasion, it is a special occasion, and it involves eating a meal” [79]. Almost two decades later, Paddock et al. [61] examined trends in eating out in the UK and explained how this activity had changed over time. Eating the main meals outside the home had become less exceptional or special but was still influenced by the diffusion of global tastes and inequalities of access. Their empirical study demonstrated that eating out had become a “dominant” practice by 2015, one that was performed informally and routinely [61]. This development is also reflected in the percentage of UK household expenditures on food used for eating away from home, which increased from 10% in 1960 to 32% in 2015 [78].

By conducting ethnographic fieldwork around Swedish youth, Wenzler [85] identified three different practices of eating out. These were “replacing-school-meal-with-other food,” “hanging out” (earning the right to sit at a table by simply ordering a small snack or drink), and “Fika.” Fika can be described as a phenomenon that consists of some kind of socialization with friends (e.g., discussing or talking) or doing something else while dining (e.g., reading). Further, Wenzler [85] outlines the impact of the price of food, the location of a venue, the venue characteristics, and the social group aspects on the eating habits of young people. While existing studies on eating out focus on a social dimension or look at cultural differences during eating practices, we will extend the current state of the art by contributing a socio-technical dimension of eating out.

2.2 Research on Smartphone Usages in Eating Contexts

There is a growing body of literature on mobile devices in food and eating contexts. Some investigations are more focused on the envisioning and prototyping of novel smartphone applications and practices around meal consumption (e.g., [27, 39, 50, 73]), while others are more centered around detailed descriptions of smartphone use and influence in different eating situations and settings (e.g., [27, 29, 57, 65, 72]). For instance, Ferdous et al. [27] designed a mobile application, *Chorus*, which aimed to ease the sharing of memories by families while eating. A chatbot, *Lunchbot*, addressed eating at the workplace by offering a lunch location voting system for colleagues who regularly eat together [73]. Lucero et al. [50] rethought the private nature of smartphone interactions with their prototype *MobiComics*. It used smartphones as public displays for a collaborative group experience of creating and editing comic strips while eating out. Jarusriboonchai et al. [39] discussed how the smartphone could act as a “ticket-to-talk” and evaluated four storyboards, one of which dealt with content sharing with strangers in cafés. Another focused on the idea of location-based invitations to spontaneous barbecues.

In a survey study, Moser et al. [57] learned that phone calls and chatting while eating are more tolerated than the use of social media and other online activities. In addition, the use of smartphones is more likely to be acceptable in the younger population. Ferdous et al. observed in [25] and [26] how technology is used by Australian families when eating at home. Su and Wang [72] carried out interviews and observational studies in Irish pubs, showing that

smartphones can be both disturbing and enhancing in conversation. Their results indicate that smartphones can give a sense of surveillance when using social media such as Facebook, but they can also be used to check conversation-relevant information on the internet. Porcheron et al. [65] looked at the influence of smartphones on conversations in pubs in the UK through an analysis of video-recorded situations in which the smartphone had impacted the conversation. They identified conditions in which using a smartphone can be “interactionally problematic”.

2.3 The Emerging Research Field of HFI

Human-Food Interaction (HFI) deals with the diversity of ways that we interact with food [16]. Current research within HFI revolves around the interplay of humans, food, and technology [3]. Khot et al. [46] describe the scope of HFI as “how we grow, shop, cook, and eat food using digital technologies”. Altarriba Bertran et al. [3] investigated the current research directions and application fields within HFI and developed a taxonomy based on a “focus and agency continuum and a single domain”. Within this so-called “focus and agency continuum,” the “focus” dimension refers to the differentiation between functionality (66% of all HFI publications), individual experience (22%), and social bonding (12%). “Agency” is represented by a continuum between technology (52%) and humans (48%). The domains are Source (15%), Store (5%), Produce (37%), Track (23%), Eat (30%), and Speculate (6%). Cultural, social, but also playful interventions tend to be less addressed within HFI [3].

A technology-centric view is currently dominating research within HFI. This technological perspective mainly focuses on using technology to manipulate current practices concerning food [3]. Several studies focus on applying chatbots to support food tracking and diet change [11, 22, 23, 30, 35], cooking at home [6], finding restaurants for people with allergies [38], organizing lunchbreaks at work [73], and educating children about healthy diets [23] and waste management [23]. Technological concepts such as *FoodGenie* [82] and *iScream!* [76] aim to encourage playful interaction directly with food, such as printing self-designed patterns made of edible materials or eating ice cream with a 3D-printed plastic ice cream cone that plays sound effects while eating. Gayler et al. [32] explored even newer technological possibilities to transform human emotions into taste and envisioned a “taste based interface” for HCI.

The importance of the intersection between social media and food has also been highlighted by studies on the potential effects of “food porn” to reduce obesity [63] and the use of Instagram to improve healthy eating [15]. The term “food porn” is understood as a desirable visual presentation of cooking or eating in advertisements, infomercials, blogs, cooking shows, or other visual media [66]. There is currently an ongoing effort to further “embrace a more human-centric stance” related to HFI [3]. These human-centric studies focus on the interactions of gastronomy and play [4, 5] or the use of technology during family mealtimes taking a “celebratory approach” [24]. Ferdous [24] investigated design opportunities to support the family mealtime experience in a way that aimed for meaningful integration of technologies into family practices [24]. By examining how children used technology in family-friendly restaurants, Davis et al. [21] revealed that

the positive experience of use is intertwined with different actors, giving “unforeseen opportunities for learning, game playing, and intergenerational interaction.” Khot and Wang [45] developed the robot, *FoBo*, which is supposed to be a social companion for people who dine alone.

3 RESEARCH GAP AND RESEARCH QUESTION

Early studies on eating highlighted that eating outside the home was a socio-spatial practice that was relatively rare. Almost 20 years later, a different picture emerges. Eating out has become an integral part of modern life and occasions not only for quick and convenient meals are on the rise [61]. With the emergence of new technologies such as smartphones [42] and wearables, the research field of HFI has developed to address food practices and the role of technology within food interactions. Su and Wang [72] and Porcheron et al. [65] have already conducted studies concerning technology use during eating out occasions. While Porcheron et al. [65] focused on smartphones as a means for stimulating and shaping conversations, Su and Wang [72] interpreted the influence that smartphones and social media use may have on pubs as third places. However, within our study, we focus on gathering insights into broader smartphone usage “in the wild,” not from a conversational perspective, but rather from a socio-technical perspective with regard to current food practices. We therefore decided to observe for longer periods (up to four hours per session) and include larger sets of participants. The longer sessions proved to be useful, as the longest period of time that people spent in our observation sessions was two hours and 44 minutes, which we otherwise could not have observed in full. This approach also allowed us to divide our observation into three phases of eating out practices (*before*, *during*, and *after* dining). We specifically contribute to the current state of research by examining the use of smartphones within all three phases of eating out and the purposes entailed. Therefore, our research question is: “How is the practice of eating out performed, and what role does mobile technology play in it?” We extend the notion of eating as a socio-spatial practice by investigating the rationales for use and non-use at various points during the eating experience. In this respect, we hope to give designers and researchers a more granular view of smartphone usage in the eating out context.

4 EMPIRICAL STUDY ON TECHNOLOGY-RELATED EATING OUT PRACTICES

To obtain insights into the role of mobile technology in eating out practices, we conducted an empirical study about mobile technology use during eating out situations. Within our empirical study, we included a qualitative in-depth interview study as well as a large observation study.

4.1 Interview Study Methodology

We conducted semi-structured interviews with predefined questions and open-form questions to allow for more in-depth follow-up as proposed by Gall et al. [31]. We interviewed 29 people (16 male, 13 female; labeled P1–P29) aged between 22 and 32 years (Table 1).

As a first step, we chose to focus primarily on young adults. The average duration of an interview was 31 minutes, and all interviews were conducted between December 2018 and August 2019. Interviews were either on-site or remote, with the locations chosen by the interviewees themselves.

After obtaining agreement to record the interview, we collected basic demographic data such as gender, age, and profession. Subsequently, we discussed the participant’s eating habits. Here, we asked the interviewees which meals they regularly eat and where the meals are normally consumed. Afterward we asked the interviewees to describe an exemplary situation of non-domestic meal consumption. In addition, we asked questions about social interactions and technology use within those situations. The interviewees were asked to further explain the role of mobile technologies within the three phases *before*, *during*, and *after* eating. In the end, all participants had the opportunity to discuss their thoughts on technology-related eating out practices and were encouraged to talk about current challenges and potentials with regard to eating situations.

All interviews were audio-recorded, fully transcribed, and analyzed. Initially, we used deductive coding along with the interview guideline before inductive codes emerged from the material [28]. The code system was reviewed in the course of several meetings among the authors. Independently of our code system, a second code system was developed by two research assistants to improve the coding reliability and validity [18]. Through discussion in a handful of meetings, similarities and interesting differences between the two code systems were compared, and a final combined code system emerged. Although the interviews were conducted in German, we translated important passages to English for this publication and tried to keep the meaning as close as possible to that in the original interviews.

4.2 Observation Study Methodology

To accompany the qualitative interview study, we conducted an observation study in different restaurants in a medium-sized German city (approximately 100,000 inhabitants) to study eating out situations in practice. As prior studies (e.g., [65, 68]) have shown that eating behavior can be influenced by observation, we adopted a covert stance. We opted for covert research after addressing the three key questions of [86] that should be asked to justify its ethical appropriateness: (1) in our case, covert observation seems to be the only way to collect authentic data, (2) furthermore, visitors in a public restaurant can expect to be viewed, and (3) all data is directly anonymized and only interpreted in aggregate form. A total of 568 customers were observed at four different venues. After we completed the observational study, the observation sheets were merged and the data manually cleaned. During the cleaning process we removed duplicate entries about the same person that were made accidentally by more than one observer. Furthermore, we decided to exclude data of customers that only ordered takeout, since we wanted to focus on customers who stayed for a substantial period (cf. [53, 68]). After data cleaning, 458 customers remained for further analysis, spread over 3 venues. The study was divided into a preliminary study (4 sessions of 2 hours each) and a main study (3 sessions of 4 hours each). During the observations, we used

Table 1: Basic information about the interviewees.

No.	Gender	Age	Residence Area	Highest Education	Eating Preference
P1	m	23	Rural	Bachelor’s degree	At home
P2	m	24	Urban	Bachelor’s degree	At home
P3	m	23	Urban	Vocational baccalaureate diploma	Eating out
P4	m	25	Urban	Vocational baccalaureate diploma	At home
P5	f	27	Rural	Bachelor’s degree	At home
P6	f	25	Urban	Bachelor’s degree	At home
P7	m	27	Urban	Bachelor’s degree	At home
P8	f	25	Urban	Bachelor’s degree	At home
P9	f	22	Urban	High school graduation	At home
P10	m	24	Suburban	Apprenticeship	At home
P11	m	28	Urban	Bachelor’s degree	At home
P12	f	28	Urban	Master’s degree	No preference
P13	m	22	Rural	High school graduation	At home
P14	m	26	Urban	Bachelor’s degree	Eating out
P15	f	26	Urban	Master’s degree	At home
P16	m	28	Suburban	Bachelor’s degree	Eating out
P17	f	28	Suburban	Master’s degree	Eating out
P18	m	24	Rural	Bachelor’s degree	At home
P19	f	28	Urban	Master’s degree	Eating out
P20	f	28	Urban	Master’s degree	No preference
P21	f	25	Rural	Apprenticeship	At home
P22	m	30	Rural	Bachelor’s degree	At home
P23	m	30	Urban	High school graduation	At home
P24	f	25	Rural	Bachelor’s degree	Eating out
P25	m	32	Urban	Master’s degree	No preference
P26	m	32	Urban	Master’s degree	No preference
P27	f	25	Urban	Bachelor’s degree	At home
P28	f	26	Rural	Bachelor’s degree	At home
P29	m	23	Rural	High school graduation	Eating out

laptops to take notes and to fill out predefined digital observation sheets. Our observation sheet included a table for overall contextual data such as the date and venue name, a short description of the observers’ seating area, and the exact starting time. The current weather conditions and outdoor temperatures were also recorded. Each customer who entered the venue was instantly assigned an ID. We also noted the arrival time (to the minute) at the venue. We further noted “assumed sex” (male/female) based on appearance and behavior. Where there was some uncertainty we added “o” to our observation sheet. “Estimated age” was based on an assumed minimum and maximum value, with 10-year boundaries. The average was then used in the analysis to assign the birthdates to broader generational cohorts (Table 2) to achieve comparability. The generational cohorts are based on the work of Bergh and Behrer [75], with the difference that we have merged the “Baby Boomer” cohort (1946–1964) with the “Silent Generation” cohort (1928–1945). Also, we added a new cohort with the simple name “Children” (born after 2012). As in the case of “sex,” however, the age distinction should again be regarded as a rough estimate.

In addition, each person was assigned to the group with which they primarily interacted during their stay. Sometimes the corresponding group was only recognizable a few minutes after entry.

Group belonging was labeled by an ascending alphabetic letter. During a person’s stay, the use of smartphones was observed. Therefore, we noted all technology interactions for each person. The use of devices was divided into three phases that matched the guidelines used in the interview study: “before,” “during,” and “after” the food intake. The intensity of use was tracked for each of the three phases, characterized as “0”: no use, “1”: short check (maximum of 10 seconds at a time), to “2”: active use of the device. A dash (“-”) was used if the use could not be reliably observed in the respective phase (e.g., due to a blocked view caused by other customers). The person’s time of leaving the venue was recorded as well.

Table 2: Generational cohorts used in the study.

Generation	Estimated Year of Birth	Age
Baby Boomer (BB)	<1965	>54 years
Generation X (Gen X)	1965 to 1979	40 to 54 years
Generation Y (Gen Y)	1980 to 1996	23 to 39 years
Generation Z (Gen Z)	1997 to 2012	7 to 22 years
Children	>2012	<7 Years

We decided to conduct a preliminary study for each observation site. The purpose of the preliminary study was to find out where observers could be placed within the venue in order to have a superb view of a large area, what number of observers would be sufficient without attracting unwanted attention, and what impact interviews near the venue could have on other guests. We also checked whether the observers in the restaurants were likely to be noticed, as they pretended to be normal guests working on their laptops.

All four sessions of the preliminary study were conducted by the first author and a research assistant in May and June 2019. The selected venues were chosen to reflect a good cross-section of the city (Table 3). Before each observation session, the owners of the respective venues approved our approach. We subdivided each observation location into different areas, giving each observer a specific space to allow observation of a maximum number of customers. During the preliminary study, informal conversational interviews [31] were conducted by the observers with customers in a few cases. Those interviews took place a few meters away from the observation venue after the customer had left it. This approach was used to avoid drawing the attention of other customers and thus possibly influencing their behavior. All three sessions of the main study were conducted in July 2019 by the same pair of observers as in the preliminary study. For those sessions we raised the observation duration for each session from two to four hours. Venues A to C were the same as in the preliminary study. Venue D was not observed, as the preliminary study showed that the small seating space made covert observation too difficult.

Within our observation study, we differentiate between three phases: (1) the role of mobile technology *before* dining that covers every interaction from the moment of entering the venue to just before testing the first piece of food; (2) the role of mobile technology *while* dining that covers every interaction from the moment of testing the first piece of food to the moment when the dish is finished, and (3) the role of mobile technology after dining that covers every interaction from the moment *after* finishing the dish to leaving the venue.

5 RESULTS: EATING OUT AND TECHNOLOGY USE

In the following, we present the results of the interview study and enhance them with the results of the observations. While the results of the interview study are qualitative, the observational study adds a quantitative perspective.

5.1 Demographic Overview

There were considerably more women than men in the observational study sample. Of the 458 observed individuals, 290 were women (64%), 160 were men (35%), and 3 (<1%) could not be classified by us. This result is in strong contrast to Martens’ study [52], in which men reported that they ate out more often than women. A re-investigation of the same study, conducted in 2015 [61], reported that women, in particular, find it important to eat outside. Our observation study indicates that women happen to eat outside more than men. Of course, other factors such as the working relationship and working hours would have to be collected to be able to make

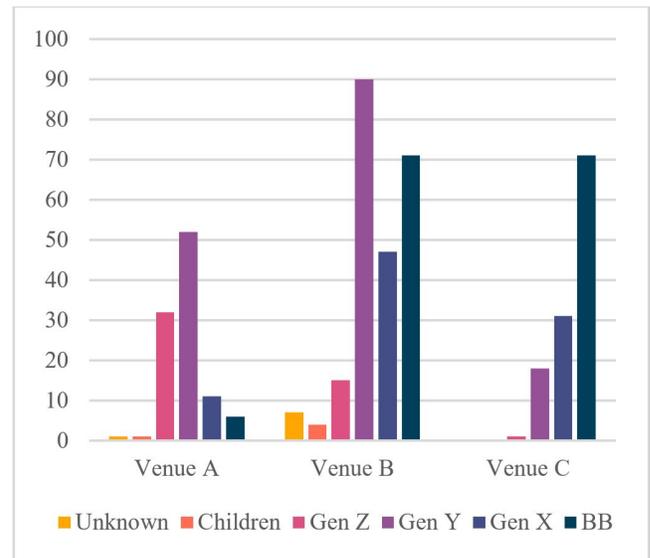


Figure 1: Age distribution of the people observed for all venues.

more valid statements about the statistical evaluation. However, this was not possible within our study. Also, our interview study did not fully support the finding as there were different opinions in general about eating outside versus cooking food at home, regardless of sex. The age distribution of the persons observed is shown in Table 4. Generation Y and Baby Boomer were the most prominent groups in our study. These two age groups accounted for just over two-thirds of the persons observed. Younger generations such as Gen Z and children were less present.

It is noticeable, if not that surprising, that different age groups appear to frequent some locations more than others. At venue A, 81% of the observed people were younger, coming from Generations Y (31%; n=32) and Z (50%; n=52), while at venue C, around 84% of the observed people were from Generation X (26%; n=31) or were Baby Boomers (59%; n=71). At venue B the age distribution was more balanced: Gen Z (6%; n=15), Gen Y (38%; n=90), Gen X (20%; n=47), and Baby Boomers (30%; n=71). The chosen venues therefore had a major impact on the observed age distribution, which can be seen in Figure 1.

5.2 Eating Practices While Eating in a Group or Alone

5.2.1 Social Group Affects Eating Behavior. Our results show that the presence (or absence) of a social group has a strong influence on the eating patterns of most interviewees as well as on those of the observed customers. Characteristically, eating in social groups is especially common in the working context (e.g., having lunch together). However, regular eating rituals are also found in times of leisure: “If it gets late at [the football] training, it’s gonna be probably McDonald’s. Yes, we actually have a fixed ritual there, the ‘MCThursday’, that’s almost every Thursday [laughs], because we always go there after training” (P18). The group eating setting, including when, where, and with whom, is often associated with

Table 3: Overview of the observation locations.

No.	Type of Venue	Place of Observation	Type of Service	Max. Observable Tables	Max. Observable Customers
A	Frozen yogurt and snack bar	indoor	Counter service	15	40
B	Café and ice cream parlor	outdoor	Table service	40	150
C	Bakery and simple lunch meals	indoor	Counter service	12	35
D	Fries stand	outdoor	Counter service	6	16

patterns of sociality found in advance. This extends even to the choice of food eaten, as shown in another statement: *“When I cook at home, I don’t cook anything with meat, just vegetables or such. But when I eat out, I always tend to pick something with meat [...] Especially when there’s lasagna, so it’s meat. And yes, if we go out for lunch with our colleagues [...] I am not the one who has to assert herself [...] The decision is also dependent on other people”* (P12). Following a group consensus appears to be more relevant for P12 than eating in a more vegetarian fashion.

When eating in a group, social factors are important, perhaps more than the food itself. For example, sustaining a friendship has a high priority for P19: *“Because I don’t have regular personal contact with my friends, we do arrange to have a meal together [...], that’s more of a celebration of food and friendship.”* Even in everyday situations, such as a lunch break, the social interaction and companionship during the meal are important: *“For me, social interaction is also very, very important. In my opinion, it is only then a break [...] and a pleasure when I can talk to people and can relax and be away from work”* (P20).

However, social interactions do not have to relate only to one’s own group; other local visitors might become part of the group’s conversation, as P28 reports: *“What is very important are the little assumptions about what happens at the other tables. [laughs] Yeah, you pay attention to what else is happening in the pub, and if, for example, there’s a couple sitting with a big age gap, then, of course, you’re always chatting about what’s going on there.”* P29 summarizes the topics of a conversation while eating out: *“I would say, however, that eighty percent of the conversations remain rather shallow; content-wise [laughs].”* Regarding group size, most of the people observed ate as couples (121 groups of two = 49% of all 248 observed groups), followed by 91 individuals (37% of the observed “groups”) and groups of three (25 groups = 10% of the observed groups). Groups of four (6 groups = 2%), groups of five (4 groups = 2%), and groups of six (1 group) were uncommon within our

Table 4: Age distribution of all people observed.

Generation	Observed persons	%
Baby Boomer (BB)	148	32,31%
Generation X (Gen X)	89	19,43%
Generation Y (Gen Y)	160	34,93%
Generation Z (Gen Z)	48	10,48%
Children	5	1,09%
Without estimated age	8	1,75%
Total	458	100%

observational study. The average duration spent in the venue for people eating in groups (two persons minimum) was 30 minutes.

5.2.2 Strong Aversion to and Fears of Eating Out Alone. A vast majority of the interviewed people are not comfortable eating out on their own, as exemplified by P9: *“Well, I never actually eat out alone anywhere. [...] I’m not going alone for a coffee or anything. It’s always been together.”* Other interviewees share this opinion and miss social interactions when they eat alone: *“I would never sit down alone in a restaurant and then have dinner, because I think it’s a kind of social thing that you go somewhere with friends or colleagues and have something to eat together [...] I don’t just eat to satisfy my basic needs, but because it’s fun together in a group”* (P12). Another person describes how he prefers to spend his lunch break together rather than alone, bringing up a lack of perceived “productivity” as a reason: *“When you’re alone, you don’t do anything productive. Well I’d say, if you went with several people, it’s not really productive either, but it feels like it’s a little more productive because you’re talking about something on the way, or at least you’re talking and it’s not dead time”* (P26). The reluctance to eat out alone led to a change in eating patterns (two meals a day), as P20 hints slightly: *“I hate to eat alone, but I can do that; I don’t like to do that, so I guess I would rather eat two meals and talk to people.”*

5.2.3 Eating Out Alone Only When Necessary. The feeling of situational discomfort when eating out alone is expressed by P19 through the detailed description of an experience: *“I actually went into a restaurant on my own, knowing that it would be very, very strange, but I wanted to have this experience. And it was super strange. I don’t know if I’ll do it again. [...] Since then I haven’t been eating alone; it was very strange when you waited for the food and then you took a look what is going on around you, but you didn’t want to look too intrusively, that’s why you looked away so quickly and it was so strange and you feel like you were being observed all the time and everyone thinks, ‘why is she sitting there alone?’ I think that there is still a certain stigma in Germany when you go out to eat alone.”*

Although the other interviewees share this opinion on eating as an unpleasant situation, they sometimes go out to eat out alone in extraordinary cases: *“So it’s more like an ‘emergency situation’ for me [...]. So, if I leave home in the morning and I didn’t make anything to take along for lunch the day before [...] and it takes longer and you still have to do this or that and then you notice, ‘oh no, it’s one [o’clock] and I haven’t eaten lunch yet’ and you’re starving to death, then I’d go and eat something so that I get myself something”* (P15).

However, one interviewee sometimes enjoys a lunch break without a social group: *“But if I’m eating outside on my own now, if that’s related to work, then I usually [...] eat on the spot, because somehow I*

find that’s a very good separation: Then you’re out for a little bit, half an hour or something and then you go back again. But most of the time I listen to something when I eat alone now, so I have my usual habits” (P7).

5.2.4 Observations Regarding Eating Out Alone. Of all persons observed, 20% (91 persons) were eating alone. This is considerably more than the 6% of all surveyed participants in the 2015 survey of Paddock et al. who stated that they were eating out alone [61]. However, a more detailed look explains this discrepancy: Considering only the persons in the study of Paddock et al. who ate a dish just for convenience, the number of people eating alone in these cases rises from 6% to 19%. And this reported 19% is surprisingly close to our 20%, which could be the first indication that we have primarily observed cases of fast food or food intake for convenience reasons. This also corresponds with our overall impression during the observations. However, our observation study clearly outlines the impact of age on the likelihood of eating out alone. Only one person of Gen Z was eating alone, which represents only 2% of all observed persons from Gen Z. However, 34% of all observed Baby Boomers ate alone. The former described an aversion to eating out alone while the latter are more likely to do so. The distribution across all age groups is illustrated in Figure 2.

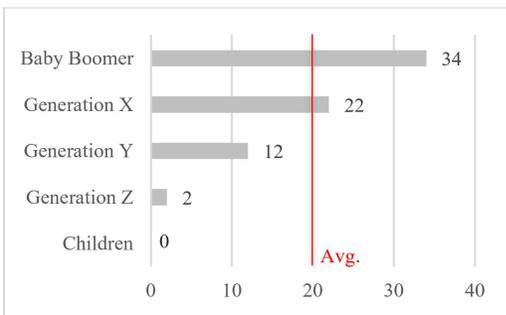


Figure 2: Percentage of people eating out alone based on age cohorts.

It is also noticeable that women are more likely to avoid eating out alone than men. While 27% of observed men were eating out alone, only 16% of women did so. It became clear that individuals who dine alone do not take as much time to eat. On average, they spend only 20 minutes at the venues, which is a third less than people who are dining in groups. But this distinction is mainly driven by the influence of the venue. Of 91 people who were eating out alone in total, 66% were observed at venue C. Since the time spent at venue C was generally rather short, the major difference in the total amount of time spent alone and in groups can be explained by group size, but especially by venue (Figure 3).

5.3 Use of Mobile Technologies in Eating Out Settings

As our main interest is in gaining insights into the use of mobile technologies and digital media with regard to eating practices, we focus in this section on the current use of technology before, during, and after eating out situations. We saw a few uses of laptops plus

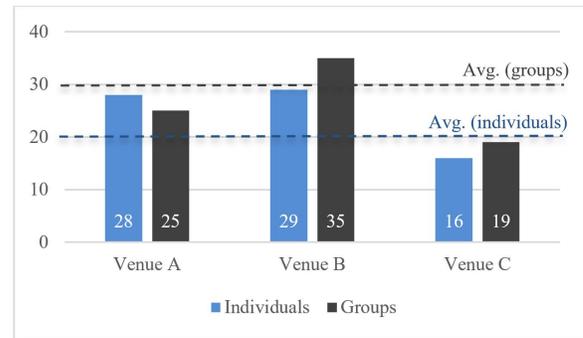


Figure 3: Average time spent (in minutes) of individuals and groups at the observed venues.

the use of one SLR camera and one tablet. No obvious interactions with smartwatches were observed. Due to the predominance of observed smartphone interactions in the study, we concentrate on smartphone interactions only.

5.3.1 Using Smartphones Before Dining. In the course of the interview study, most interviewees (in 14 out of 29 interviews) mentioned searching for appropriate dining options via the smartphone. Such searches include acquiring information about meal offers, operating hours, and menus. Google Search and Google Maps play the most prominent role (P4, P7, P8, P14, P19, P20, P23). Other platforms such as TripAdvisor (P8, P15, P20), Instagram (P15, P19), Yelp (P7), and Apple Maps (P23) also provide relevant information for the interviewees. In general, people are interested in menus, user ratings, and star rankings to estimate a price–performance ratio and in visitor numbers to estimate waiting times. This information may lead to social conflicts, as P7 implies: “[...] and if we found something there then I am somehow the mean nerd who looks at the smartphone again and again to see what the last reviews from the last weeks or so are like.” This kind of information gathering is more likely when dining in an unknown location. Another mode of information gathering is to look up unknown ingredients from the menu when one is already in the restaurant. Eight interviewees mentioned that the smartphone is used for navigation to get to a selected restaurant. Three said that they used Google Maps; the others did not describe the action in more detail.

Before dining, the smartphone may be used to make reservations. This process is usually conducted rather traditionally with a phone call. Through instant messaging services, restaurant suggestions are also sent as weblinks to friends or acquaintances. The interviewees further used their smartphones to redeem digital coupon codes. Our interviews uncovered the use of smartphones for taking pictures of the food. Additionally, our observation study showed that pictures are usually taken as soon as the food is put on the table, prior to testing it (cf. the discussions around food porn [66]). In total, we were able to observe 30 situations in which the people took pictures of their food. Of these pictures, 70% were taken by people within Generation Y. The other 30% of the situations were spread relatively evenly over Gen X, Z, and Baby Boomers. Most of the pictures were taken in the phase before dining.

The general interview statements about food pictures are diverse. Some interviewees see strong benefits in taking pictures, as P11 explained: *“If you have a picture, you can show it to the world; and sometimes you do. [...] if you’ve discovered something new where you think there should be more people or that’s something especially sustainable.”* Another interviewee sees sharing pictures as fun in itself, but questions the deeper meaning of the sharing: *“It is just for fun or in a way you are so happy about the food that you have to share it with the people, but in the end, it is also totally unimportant”* (P12). There are also some negative voices with little or no sympathy for food photography: *“I’m one who is not really into it. So, if people take pictures of every meal, always and in every restaurant, I get sick. [Laughs] No, I don’t need it. I see it, I just eat it”* (P29). P18 has an even clearer opinion toward the sharing of food-related content via social media: *“I completely reject that. And I’ll kick anyone off my friends list if they do”* (P18).

To exemplify the strength of the aversion to the practice of taking food pictures within our interview sample, we coded all transcripts with regard to photo sharing services such as Instagram and assigned each passage to one of the three categories: “Positive comment,” “Negative comment,” or “Neutral Comment.” We found a total of 23 statements spread over 15 interviewees. The results show a reasonably balanced attitude toward Instagram in the sample, with a tendency to dislike sharing food pictures publicly. Instead, quite a number of these people (10 interviewees) reported on how they preferred to send their food pictures privately via instant messaging services such as WhatsApp to family, friends, or small groups of friends. Although this study was specifically about eating out situations, many respondents also mentioned that they like to take pictures of homemade dishes.

Another crucial use case of using mobile technologies before eating was in the area of entertainment. The interviewees told us that they use their smartphones to play podcasts or music on the way to the lunch or dinner venue. P2 described it as almost a ritual. However, he also pointed out that he only uses the smartphone for entertainment when he’s eating alone. In the observational study, another customer came into a venue with headphones on and was happily tapping to music while waiting for his food. No other types of entertainment were reported or observed before eating.

5.3.2 Using Smartphones While Dining. There are some distinct differences between the behavior before dining and the behavior during dining. Most noticeable is a rather strong aversion to general smartphone use during this phase. When a smartphone is used, it is used mainly to support conversation. This happens by showing photos of past events, by sending pictures to people who are currently not attending the dining session, or by showcasing “funny” pictures as well. Others used the smartphone for quickly looking up facts (“fact-checking”) to confirm or refute one’s statements or those of others. Only two participants talked about how they use their digital calendars to plan new appointments. However, besides actively using the smartphone, the observed participants passively accessed information. Many participants reacted directly to notifications and took a quick look. P8 summarized the omnipresence of the smartphone: *“My smartphone is **always on the table.**”*

The smartphone is heavily used during dining for entertainment reasons when eating alone. Participants reported that they like to

watch YouTube videos on their smartphones. Others prefer listening to audiobooks or podcasts. Another person talked about browsing through Imgur (an online image sharing community) or Tinder profiles. Here it is arguable whether the use of Tinder should be categorized as a social way of communication with other people or as entertainment (cf. [74]).

During dining, 19 of the 29 interviewed persons were slightly negative about the use of smartphones and sometimes volunteered thoughts about this subject. Several participants mentioned that they even ignore phone calls or switch the smartphone to silent mode so that they are not disturbed while eating. Instead, they just want to enjoy their meal, as P18 explains: *“[...] because I love to enjoy the food and I don’t want to be busy with my smartphone.”* P9 even blames parenting as a reason for her rejection of smartphone usage while dining: *“Somehow I grew up with it, you weren’t allowed to. And I also find it disturbing.”* Another participant describes it as *“impolite when there are several [people sitting] at the table and you have the smartphone in your hand”* (P26). In particular, this negative attitude toward the use of smartphones is evident when dining in a social group: *“Well, I don’t like it when I go out for dinner and someone fiddles with their mobile phone, [...]. If I am alone, I do it too, but with others together by no means”* (P6).

This aversion toward the use of smartphones during eating out situations was also noticed in the observation study: of all persons observed, 41% (188 persons) did not use their smartphone at any time while in the venue. However, complete non-use appears to depend on age more than on group size or gender. It becomes particularly evident among the Baby Boomers, where people who are not using smartphones at all are in the majority with 64% (Figure 4).

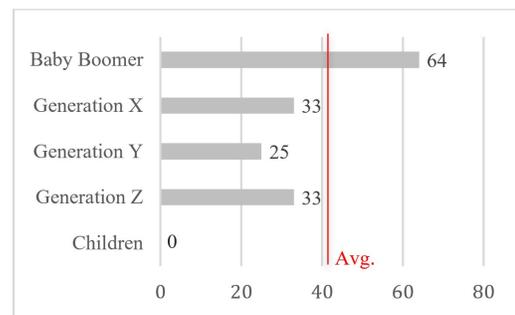


Figure 4: Percentage of people not using smartphones while eating out alone based on age cohorts.

5.3.3 Using Smartphones After Dining. In general, the use of smartphones directly after eating was least discussed by our interviewees. However, similar to the previous phase, the smartphone is used to support the conversation within the restaurant mainly through the sharing of pictures. The smartphone is used for making follow-up appointments with friends or simply to chat with other friends via instant messaging services—even when in a group. After dining, participants begin to check all messages received during dining. Especially those people (e.g., P26) who rejected smartphone usage during dining, talked about a big urge to check the missed messages

after dining. After dining, almost no participants took pictures. One of our interviewees said that he occasionally takes photos: “*Afterwards probably a group picture if you haven’t seen the people for a while*” (P16).

A further activity that occurred after dining was the tracking of nutrition. P12 brought up the term “awareness”: “*And then I decided to become aware of what I actually ate during the entire day and how much and what I ate.*” Another activity that was observed only after eating was giving feedback via smartphone. This action is limited to the evaluation of the dinner via restaurant review apps. Two persons (P4, P7) stated that they only gave feedback on good experiences, which is why, according to their statements, they have only written positive evaluations so far. After finishing the meal, the smartphone is again used for entertainment purposes. Listening to music, reading, and scrolling through social media are activities that have been described. Slowly the participants revert to their typical uses of smartphones, implying that the rituals of eating out are somehow demarcated from other routines and that this boundary setting is closely related to immediate sociality.

6 DISCUSSION

Below, we discuss some of the design spaces derived from our empirical analysis of eating out practices. We further outline implications on how to address these design spaces, such as designing for before and after eating, the non-use of devices if eating out is happening in a social group, avoidance or toleration of eating out alone situations, and ways to share photos meaningfully.

6.1 Designing for Eating Out Contexts in Group Settings Through the Design of the “Non-Use” of Mobile Devices

Our empirical study shows strong and fairly consistent opposition to the use of smartphones during the actual dining practice. While eating in groups, many people want to focus on social interactions within the group in addition to the eating activity in itself. Looking at the smartphone is perceived and condemned as impolite, whether or not the smartphone is “*always on the table*” (P8). When individuals do look at their smartphones, it is mainly to support the flow of conversation with others. For this purpose, either pictures are shown or facts are searched online that match the conversation thematically. Smartphone users tend not to respond to notifications in these situations. This opens up possibilities to design the smartphone lying on the table for interaction within social settings. For example, sensors could be used to detect the position of the mobile device and turn off annoying notifications, or a second screen on the back of the device could only provide information appropriate to the conversation (“Eating mode”). However, the distinction between eating in groups and eating alone is critical here, as dining alone does not carry the same implications.

When it comes to supporting group settings, we argue, it is crucial to design for non-use. Research on non-use in HCI has collected different forms of non-use [69, 87] that vary due to agency, context, and digital imperative [7]. Within this research field, we direct our discussion to what Baumer et al. [7] frame in opposition to the Silicon Valley dogma of technology-driven solutions: a design space for non-use, as “there are times when not using a technology may

in fact be desirable.” As we have observed, in group settings the smartphone is often ignored, switched to silent mode, or turned off. In addition to those phone setting alterations, Lee et al. [49] have found other non-use methods such as intervention software use, physical separation, setting detailed non-use goals, and downgrading (e.g., changing data plans or falling back to feature phones).

Designers, therefore, need to focus primarily on the phases before and after the actual eating, as smartphone use is more common and is socially accepted during these times. Nevertheless, some opportunities exist for supporting social groups while dining. For example, table concepts such as the *Table Talk Enhancer*, which focuses on leveling the speech utterance rates of all dining partners [59], could also analyze the spoken conversation and implicitly supplement it with interesting and relevant information on demand. Of course, such interaction raises new questions regarding privacy and data protection, not to mention potential disturbance of the social dynamic. The significant aspect here is finding methods to support, rather than obstruct, conversational flow and the interaction of food and humans. For example, a simple, completely analog and unobtrusive table concept, *Keep Up With Me*, is designed to adapt to the eating speed of dining companions [54].

When incorporating digital artifacts into the design of the before and after eating out phases, it should also be borne in mind that there is a phase in between, in which many people want to prevent their own use of the phone (and develop methods to do so when eating in a group). However, these strategies are often not easy to integrate into everyday life [49]. Designers should, therefore, consider the interfaces between the phases of eating out with respect to use and non-use transitions and support the implementation of non-use strategies.

6.2 Designing to Enhance Eating Out Alone Through Food-based Social Relationships

The situation is different when people eat out alone and would rather eat out with somebody else. In such circumstances, when the smartphone is in use, common applications include entertainment as well as search. Here potential opportunities exist for enhancing social relationships. People eating alone demonstrate an interest in their surroundings, sometimes looking around and observing others. The high engagement of users with location-based apps (e.g., Tinder and Grindr) have demonstrated how social connections for the purpose of finding a (romantic) partner can be successful. An app that supports temporary social alignments in eating out alone contexts has potential, as existing apps such as *foodfriends* [2] and *EatWith* [1] show.

This approach might extend usefully into the period before dining out by providing social profiles for people who wish to explore the possibility of dining partners. Furthermore, people who are familiar with each other, or who at least share similar interests, can be encouraged to meet for a shared meal. However, such functionalities are to be implemented with care. For instance, platforms that support accommodation sharing, such as “Couchsurfing” (which is considered a form of “prototypical sharing” [8] or even a “socio-romantic sharing utopia” [37]), are known for the unintended use of finding (sexual) dates with other people, which is distorting the actual mission of Couchsurfing [12]. This nonpreferred use leaves

many people dissatisfied, either because they do not want to be asked for romantic dates and feel harassed [12] or because they do not find any dates on the platform. Because dining is a common practice for a (first) date with a potential romantic partner [55, 56], designers need to support both objectives: serendipitous meetings of strangers who have merely the intention to eat out in company, as well as those who want to meet potential partners or make friends. Disambiguating these different motivations will be significant. Other possibilities for connecting people who would like to eat with someone else rather than alone include integrating various information seeking functionalities such as looking up restaurant-related information or rankings and making reservations. Social profiles can help to identify common interests that might facilitate consensual restaurant meetings and also act to support conversational possibilities. However, because of the risks and challenges just described (and probably also because of others), many of these apps (e.g., *Groupier*, *LeftOverSwap*, and *HomeDine*) have failed in practice and could not establish themselves [20, 80].

6.3 Designing to Cope with Eating Out Alone Through Technological Companions

But even when designing to reduce unwanted eating out alone experiences, it can easily happen that people eat alone who prefer not to be alone. Our findings indicate that people, especially those from the younger generations, feel discomfort when eating alone. Spence et al. [71] support this finding by referencing various studies ([19, 41, 64, 67]) in which people were worried about being perceived as “lonely losers” when eating out alone. Nevertheless, Spence et al. [71] point out that mobile devices have the potential to reduce this feeling and see initial evidence that this social stigma is being dismantled. In the case of eating alone, for designers it is all about making the stay at a restaurant as pleasant as possible. Besides real-world physical possibilities—a flexible room layout or adjustments to the seating and tables, for example—various technological approaches could be pursued as an adjunct to the smartphone, such as an accompanying robot, using playful technologies to encourage interaction or digital contact with other people.

There is also a design space for the possibility of replacing the missing human conversational partner with a digital artifact combined with the smartphone, such as a chatbot. In this way, a conversation could still be held that allows for some kind of social interaction and at the same time could have a certain entertainment value. This may sound disturbing at first, and people’s acceptance of anthropomorphized chatbots and robots is still difficult to assess [36, 81], but prototypes such as the companion robot *FoBo* [45] and the successes of social chatbots, including *Rinna* and *XiaoIce* [70], show that this approach is not to be neglected.

Other approaches to design for coping with unwanted eating out alone include the possibility of improving the perceived “copresence” [10, 34] of a friend or a family member who is physically not present at the restaurant in the moment of eating out. By using technological concepts such as augmented reality or virtual reality, social interaction in such eating situations could be made possible. Perhaps the other persons could even be eating at the same time, but at a different place, as already envisioned by *CoDine*, which enables remote dining via an interactive table system [83]. Thus, the need

for social interaction is fostered. The approach is not restricted to the smartphone but becomes even more interesting when it comes to designing applications for glasses, contact lenses, or digital interactive table systems to better cope with eating out alone situations. Existing telepresence concepts, such as *Room2Room* [62], *Holoporation* [60], or *BeamLite* [40], can be checked for their applicability to the context of eating out.

A further possibility lies in expanding entertainment facilities in such a way that they are timed to coincide with the approximate lengths of the stays in venues. Currently, we see that people like to watch videos on platforms like YouTube when they are eating out alone, but there are few simple means available for people to tailor content in such a way that their enjoyment of entertainment materials is not curtailed. Providing access to content that is specifically designed to align with the length of a meal or that enhances the experience of eating by providing relevant content (ingredients, recipes, food literacy, wines to accompany, and so on) would appear easy to facilitate. Display mechanisms can be varied, with provisions for television screens, access via mobile phones, tablets, tabletop screens, etc., all being possible. It may be that allowing votes on “what to watch” might improve the social experience.

6.4 Designing More Discrete Ways to Share Food Photos Through Moving Beyond Social Media Such As Instagram

We showed that, although people like taking photos of food, they are not always inclined to share them publicly on social media. Instead, a considerable number of people prefer to send those pictures privately via instant messaging to family and friends. However, current instant messaging services, such as WhatsApp or Telegram, do not support categorizing and archiving photos. The time-based collections of mutually shared photos do not allow users to re-experience the captured moments in an appropriate way. It seems therefore crucial to include additional features in existing instant messaging services, which aim to support the practice of sharing food photos in a more personal way. However, Karapanos et al. [44] found out that WhatsApp is already used as a tool for *collective lifelogging* through sharing memories and photos of important events in family groups. Still, it is questionable how such food picture sharing in groups can be connected to other interested people via instant messaging, or how group members can avoid unwanted information. Our results also revealed that some social network users disapprove of sharing food photos and may even remove people who post them from their friends list. The social negotiation process around foodporn might be one reason that these photos are now shared more in private instant messaging services than in social networks. Designers must consider how food photos in social networks could reach only people who like such pictures and how to spare people from those photos who would be annoyed by them.

Alternatively, completely new solutions could be designed independently of existing instant messaging services or social networks to handle this design space. This approach is pursued, for example, with the research project *Rendezfood* (<http://rendezfood.de/>).

7 CONCLUSION

Recently there has been a developing interest in the broad research area of Human-Food Interaction. As most current work focuses on designing new types of applications for supporting different food practices, we see a gap in examining the actual usage of smartphones within eating out contexts. We therefore conducted an empirical study on the practice of eating out and the use of smartphones *before*, *during*, and *after* eating. We applied a qualitative interview study complemented by a large observational study within different restaurant settings. We outline five design spaces relevant to mobile approaches that deal with eating out contexts:

- When designing for eating out contexts in social groups, designers should focus on the phases “before” and “after” eating, while the actual eating practice needs support through designing for non-use.
- Designing digital artifacts that are not disruptive but still facilitate the practice of eating out.
- Reducing the unpleasantness of situations in which people have to eat out alone, especially by designing for connections with like-minded people or for interactions with supportive technology.
- Designing for serendipitous meetings of people for both romantic and non-romantic dates to cope with situations where someone has to eat out alone.
- Designing new ways to support a more discrete method of sharing food photos beyond typical instant messaging services.

Our study has certain limitations. First, we focused on one specific region in Europe. It would certainly be valuable to conduct a similar study in a different cultural region to gain more insights into cultural differences with regard to smartphone usage during the practice of eating out. Concerning our observational study, the ordering process differed between the observed venues, and we saw that this factor was a major influence in the study that we had not considered in advance. For example, three venues offered only a self-service option. Only venue B provided service, and at this specific venue the phase “before eating” lasted much longer than at the others. Future observational studies that desire to examine eating out contexts must carefully consider what influence self-service might have.

Furthermore, short smartphone checks might have been overlooked by us during the observational study. A video-monitored observation study (cf. [13, 48, 51]) could have improved the data on the exact usage of smartphones in eating out situations. However, such a study poses various challenges regarding customer privacy. Alternatively, participants who have been previously invited could be observed, as in the study of Porcheron et al. [65], although short smartphone checks were not analyzed there either.

While we know that weather conditions have an effect on the practice of eating out [85], we were not able to examine these effects, as all observations were conducted on dry, mild days. With regard to our interview study, we interviewed only young adults aged between 22 and 32 years. In further interview studies, it would be interesting to learn more about the eating practices and smartphone interactions of younger generations (7–21) and older adults (55+ years) and to compare them to the results presented here. People

from the older generation in particular, who were much more likely to eat alone, could be a particular focus for future work, especially given that the likelihood of them using mobile phones was much lower. Spence et al. [71] support this argument, as the benefits of eating together are particularly beneficial for the oldest societal members.

A last point that needs to be made is that there are no natural outer boundaries to notions of “before” and “after” eating. The boundaries we placed were entirely pragmatic because our methods did not extend to identifying what organizational work was done before arrival at a venue, nor what social interactions that came after eating (for instance, going on to drink somewhere else) took place.

As future work, we wish to expand our empirical findings by learning more about the use of technology in the context of eating out by older people and especially by food influencers (as “extreme users” [33]). The activity of professionally creating and sharing photos could reveal an interesting contrast and could make further design spaces visible. Although the limitations of our study cannot be fully dismissed, they do not reduce the authenticity of the narratives presented and analyzed in this paper. Within our paper, we contribute design spaces and initial implications that could inform future HFI work concerning food-focused practices, and we especially try to inspire those who are designing to support the practice of eating out.

ACKNOWLEDGMENTS

This work was carried out within the scope of the project Rendez-food (EFRE-0801425), which is funded by the European Regional Development Fund. We sincerely thank Sabrina Brodesser, Andreas Wiebe, and Sebastian Schwarzloh for their contributions to this work. Furthermore, we would like to thank all participants who took part in the study.

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